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Forest Pest Management
Pacific Northwest Region

FOREST PEST EVALUATION

POLK N PLANNING AREA

RANDLE RANGER DISTRICT

FOREST PEST SURVEY
POLK N PLANNING AREA
RANDLE RANGER DISTRICT
GIFFORD PINCHOT NATIONAL FOREST

by

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Introduction

On June 17 to 20, July 8 to 11, and July 23 to 25, 1985, a Forest Pest Management crew surveyed the Polk N Planning Area (T. 12 N., R. 8 E., secs. 19, 20, 21, 28, 29, and 30), Randle Ranger District, Gifford Pinchot National Forest (Figure 1). As a result of reported damage and personal observations of the area, Gary Wright of the District silviculture staff suspected a high incidence of root diseases in these stands and requested assistance in assessing incidence of pests, locating and mapping pest-damaged areas, and formulating management alternatives for minimizing current and future losses.

Site and Stand Characteristics

The Polk N Planning Area is located on north aspects facing the Cowlitz River Valley. It is bordered by Roads 122 and 126 to the west, Kilborn Creek to the east, private land to the north, and Road 126 to the south. Approximately 1200 acres are included in the area. Elevation ranges from 1100 to 2800 feet. Terrain is generally steep in the southern portion of the survey area, averaging 60 to 65 percent, but exceeding 80 to 90 percent on a few faces. In the northern part of the area the ground is gentler, averaging 20 to 30 percent. Soils are very light and porous, containing a large portion of volcanic tuff. Site quality is very good. Old roads are present where past logging was done. First entries appeared to have been made to harvest large redcedar. Some Douglas-fir were taken, mainly in salvage operations during the 1930's and 1940's. The most extensive cutting had been done on the gentle slopes where relatively pure stands of alder now occur. At least one timber sale has been set up within the surveyed area but has not yet been logged. Trees are also marked for a commercial thinning in one unit. Proposed road locations are marked.

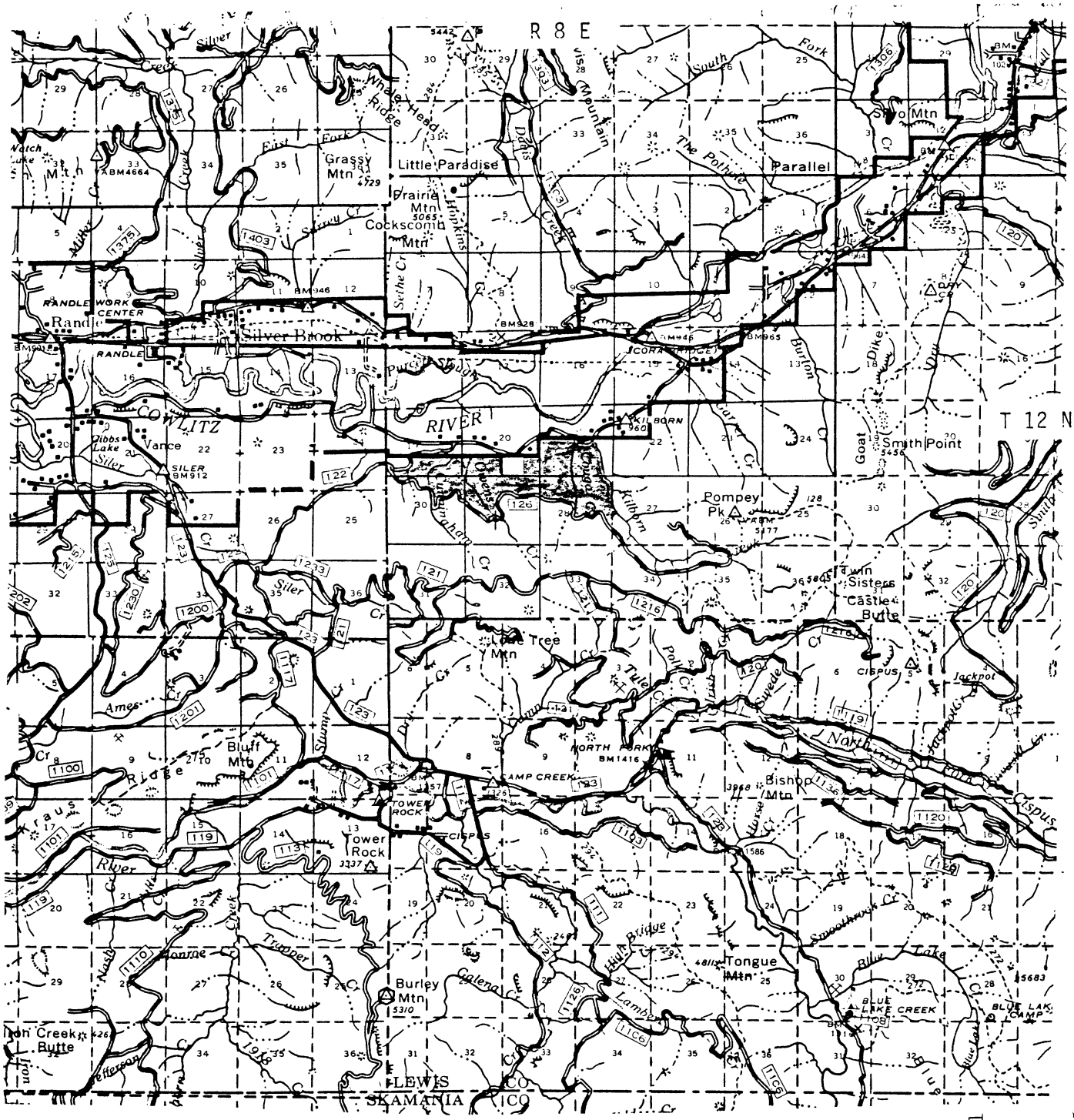


Figure 1. Map depicting location (shadding and star) of the survey area, Randle RD, Gifford Pinchot NF

A variety of stands occur within the survey area. Hardwoods, especially red alder, predominate over a large portion of the northwest part. Douglas-fir is the dominant conifer. Several stand ages exist; 60- to 70-year-old timber and old growth make up the bulk of these stands. In a few areas, Douglas-fir is growing in relatively pure stands but, in most areas, other species, including redcedar and western hemlock, make up a significant portion of the stocking.

Methods

The survey was done by running parallel transects across the area. Most lines were placed 5 chains apart, especially in the western portion of the area. Spacing between lines was increased to 10 chains in the eastern part of the area because of time constraints. While running transects, surveyors reconnoitered areas 2-1/2 chains wide on either side of lines for evidence of pest-caused damage such as dead and dying trees, understocked areas, or areas lacking root disease-susceptible species. Suspect areas were scrutinized for windthrown trees and broken or hollow stubs which, when encountered, were further inspected for signs of root diseases. Individual dead and live symptomatic trees were examined to determine what pests were affecting them. Diagnosing pests on individual trees involved (a) removing a section of the bark from the bole of dead trees to check for bark beetles or their galleries, and (b) exposing one or more large roots to check for stained wood or mycelia of root disease fungi.

Root disease areas were mapped with boundaries based on the furthest extent of dead or symptomatic trees on the periphery of centers.

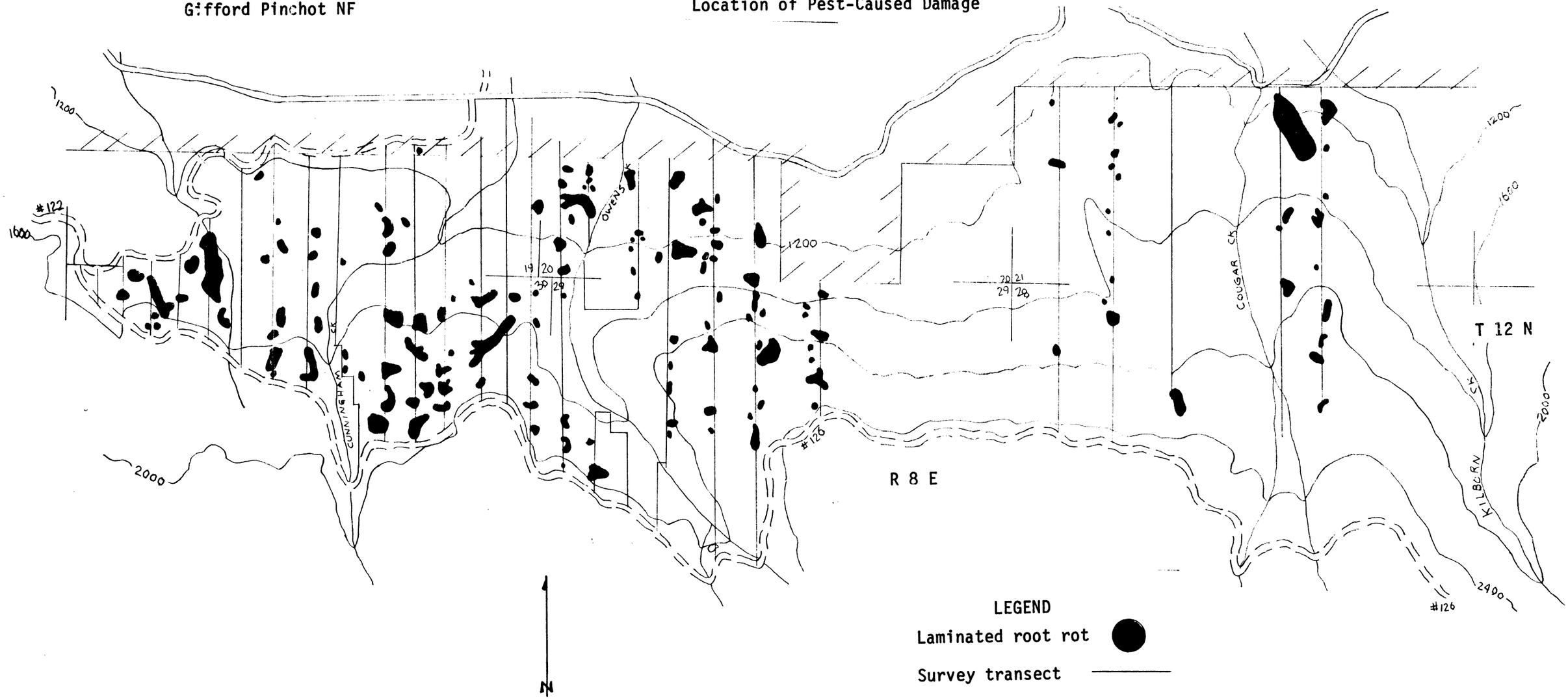
Results and Discussion

Laminated root rot, caused by Phellinus weirii, was the most frequently encountered mortality-causing pest in the survey. Various levels of damage occurred throughout the evaluated area (Figure 2). Stands in the surveyed area with the highest incidence of disease were in the western one-third and in a smaller area east of Cougar Creek. Douglas-fir was the only species affected significantly. Damage involved tree mortality and understocking in disease centers. Centers varied in size from less than 0.5 acres up to 1.5 acres. All age classes were affected, although the greatest amount of damage occurred in the younger age classes. Mortality, especially windthrow induced by root rot, was common in these younger trees. Mortality was less frequently observed in older trees. Many Douglas-firs within or on the periphery of infection centers probably are infected but have not yet started to exhibit crown symptoms; they were not identified as infected in the survey. Based on recent studies done in British Columbia and eastern Washington, we suspect that only 50 percent of the trees actually infected produce crown symptoms.

A moderate level of Douglas-fir beetle (Dendroctonus pseudotsugae) damage was encountered in the survey. Almost all was associated with laminated root rot. Insect-attacked trees were usually P. weirii-infected dead-down or standing trees. Douglas-fir beetles appeared to have infested primarily root diseased-timber and had not attacked adjacent healthy timber.

Polk N Planning Area
Randle RD
Gifford Pinchot NF

Location of Pest-Caused Damage



LEGEND

Laminated root rot

Survey transect

SCALE

20 40

CHAINS

cls 3/00

Figure 2

Schweinitzii butt rot, caused by Phaeolus schweinitzii, was found in scattered individual trees and occasionally in small centers of two or three trees. Damage was limited to decay in live standing trees and mortality and loss in rees which had failed. Incidence of damage usually exceeds visible evidence ecause the only indicator of infection on live trees is the characteristic ushroom. Mushrooms are not always present on or near trees that are infected.

While P. schweinitzii mushrooms are not hard to see, surveyors must pass relatively close to them in order to spot them. An estimated 20 to 30 percent of infected trees in these stands were recognized.

Disease Biology and Identification

Laminated root rot is one of the most damaging forest diseases in western Washington and Oregon. An estimated 5 percent of the area in West Side Douglas-fir stands is affected by this disease. Recent root disease surveys on the Randle District of the Gifford Pinchot National Forest indicate a higher level of occurrence than the Regional average.

Excessive mortality often indicates the presence of laminated root rot centers, especially in young stands. In addition to dead and windthrown trees, crown symptoms usually are seen on trees with extensive root infections. These include crown thinning, chlorosis, and decreased leader and terminal growth. In stands similar to most of those in the survey area, root disease centers are partially or fully stocked with less root disease-susceptible, shade-tolerant species such as western hemlock and western redcedar which have replaced Douglas-firs that have died. Evidence of disease may be apparent at the perimeter of centers where Douglas-fir stocking is declining and disease signs and symptoms may be observed. Since crown symptoms often are difficult to ecognize on large trees, and disease centers often are stocked with hemlock and cedar, laminated root rot-affected areas are harder to recognize in overmature stands than in young stands. Usually, evidence of Douglas-firs that died many years ago can be found if suspect areas are thoroughly inspected.

Trees exhibiting crown symptoms usually have at least 50 percent of their root system decayed. Such trees are prone to windthrow. Diseased windthrown trees frequently will exhibit root balls, remnants of root systems that are decayed and broken off just below the root collar. Exposed decayed wood will usually have characteristic delaminations along the annual rings, pitting, and growth of reddish-brown setal hyphae between the sheets of decayed wood (Plate 1).

Living-diseased and recently killed trees often will have whitish, crusty ectotrophic mycelia of the fungus growing on the surface of infected roots. On larger trees, this mycelia often is found in bark crevices (Plate 2).

Phellinus weirii damages its hosts by attacking, killing, and decaying their roots. P. weirii spreads on the surface of roots, grows to the root collar, then spreads outwards on other roots. The period of time from initial infection to tree mortality is proportional to the size of the tree (root system). Young saplings may die within only a few years of infection. Trees which become infected when they are mature tend to survive for many years. During the time between infection and death, rate of tree growth can be greatly diminished.

Mortality can result from windthrow of trees which have decayed root systems. rees on sheltered aspects may die standing or topple when most of their tructural support is gone. As previously mentioned, bark beetles frequently attack dying trees, resulting in more rapid tree death.

Variability in conifer species susceptibility exists in western Washington mixed-conifer stands. The most susceptible species in the survey area is Douglas-fir; western hemlock is intermediately susceptible. Western redcedar is resistant to infection. All hardwoods are immune.

P. weirii can survive for up to 50 years on dead host material (large roots and stumps). New infections occur when roots of healthy susceptible trees contact this material. P. weirii can thus remain on the site, infecting subsequent generations. Centers develop when the pathogen grows from diseased trees and infects healthy trees via root contacts or grafts. The rate of expansion can be as much as 1 to 2 feet per year. Stocking by less susceptible species may slow the rate of expansion.

Schweinitzii Butt Rot

Schweinitzii butt rot is common in mature and old-growth Douglas-fir. It is only occasionally seen causing damage in stands less than 100 years old. It causes decay of the root system and butt. P. schweinitzii is usually not very aggressive; tree decline is slow. Mortality, if it occurs, usually results from windbreak or windthrow due to loss of structural support. One or more other pests may be associated with mortality.

Schweinitzii butt rot seldom affects a high percentage of trees in stands. pecial control measures are seldom required. Infection of new stands following harvest and regeneration does not appear to be a major problem. Root contacts probably are the primary cause of spread within stands. Most infection centers include only a few trees.

The presence of "velvet top" fruiting bodies is the best indicator of decay (Plate 3). Trees that have failed will exhibit the characteristic brown cubical rot caused by the fungus.

Douglas-fir Beetles

The Douglas-fir beetle is an opportunistic insect, usually maintained at endemic levels on storm-damaged, windthrown, and disease-weakened Douglas-fir in which it feeds and reproduces. When a large amount of this preferred host material becomes available and populations build to high levels, outbreaks involving adjacent healthy, vigorous trees may develop. Outbreaks involving healthy trees usually decline rapidly over a 2- to 3-year period.

The Douglas-fir beetle has one generation annually. Adults and some large larvae overwinter. The adults emerge and attack from April to June. Some adults reemerge and attack additional trees. Adults from overwintering larvae emerge and attack in July and August. In western Washington, host vigor is the main factor which affects Douglas-fir beetles. Numerous low-vigor trees favor population buildups.

Alternatives and Management Recommendations

Pests are causing significant losses in the Polk N Planning Area. Current and future losses can be lessened through appropriate stand management. This can include prioritizing areas for treatment, practicing species manipulation, and shortening the length of rotation.

The most serious pest in the survey area is laminated root rot. High incidence of infection and damage occur in most stands containing a large Douglas-fir component. Douglas-fir beetles have been most active in laminated root rot pockets, killing trees predisposed by P. weirii. Deferring treatment in severely diseased stands will result in additional yield losses and expansion of root disease centers. If Douglas-fir were regenerated on untreated diseased sites following harvest, yield losses in the next generation could approach 50 percent by rotation age.

In the sale planning process, incidence of root diseases should be a dominant factor in determining size and location of unit boundaries and total area to be treated. Management action should concentrate on treating stands most severely affected by laminated root rot. Maps indicating locations of disease centers should be used as a tool in prioritizing areas for treatment. They should not be used to determine exact locations or extent of infection centers. While most information indicated on root disease location maps is accurate, areas two or more chains away from transects may have been less thoroughly examined than areas along lines.

The following recommendations are suggested.

Immature Stands

Immature stands are present in several portions of the survey area. These are largely small sawlog-sized Douglas-fir not yet ready for final removal.

Immature stands suffer the highest levels of loss due to laminated root rot. Mortality is extensive, often occurring as a result of windthrow. Douglas-fir beetles frequently infest the disease-weakened trees. Young stands with high incidence of root diseases should have the highest priority for treatment. Most of these stands also are stocked with redcedar and western hemlock that is not being affected or is being affected at much less damaging levels than Douglas-fir. Immature Douglas-fir/hemlock/cedar stands infected with P. weirii do not have to be treated with regeneration cut systems. Intermediate entries are the most viable silvicultural treatments in most immature stands. Where root diseases are widespread, large areas can and should be treated. Restrictions are mainly operational, involving topography, logging systems, access, etc.

One of the following treatments should be carried out, depending on stocking of non-susceptible species:

1. A commercial thinning is recommended for immature stands that are fully stocked with nonsusceptible species. In diseased portions of stands to be

treated, full stocking of nonsusceptible hosts should be retained. Red alder, redcedar, and western hemlock should not be marked for removal unless they exceed target stocking. The periphery of disease centers should be marked. Treatment area should extend two normal tree spacings beyond symptomatic trees on the perimeter of centers. All Douglas-firs should be removed from centers and buffers. Marking crews should be trained in recognizing signs and symptoms of root diseases. In stands to be treated, they need to be provided with a marking plan in which disease management strategies are clearly presented. Disease centers, individual infected symptomatic trees and the extent of infection need to be recognized by these crews.

2. In stands without full stocking of resistant or less-susceptible species with laminated root rot, reduced length of rotation without intermediate treatment may be the most viable option. Such stands should be entered as soon as a commercial entry is feasible. A regeneration-type harvest should be done and the site stocked with resistant/less-susceptible species.

Mature Stands

Damage in mature stands is often not as dramatic as in younger stands. Some alder, hemlock, or cedar stocking usually occurs where Douglas-firs have died out. Mortality may be occurring towards the edges of centers.

Treating mature Douglas-fir stands affected by laminated root rot is best done with a regeneration harvest. Disease centers should be regenerated with species not susceptible to damage. In stands with one or more well-adapted alternative species, this strategy has an excellent chance of success.

Planting IMMUNE--bigleaf maple, red alder, RESISTANT--western redcedar or TOLERANT--western white pine will minimize future losses and perpetuation of infective material in the soil. Following at least a 50-year rotation of such species and excluding Douglas-fir from the site, Douglas-fir could be safely grown. During this period, inoculum within the soil will decay to the point that it is no longer infective. Western hemlock, a species intermediately susceptible to *P. weirii*, can be grown in disease centers with minimal loss over a generation; however, some trees may become infected, and a minimal amount of infection hazard may be present following harvest of the stand. This low amount of hazard is at a level acceptable to forest managers. If western white pine is to be used, the blister rust resistance of planting stock should match that required by the site. Forest Pest Management will determine this upon request.

The northerly exposure throughout most of the survey area will simplify establishment of species other than Douglas-fir. Shade-tolerant species, such as western hemlock and possibly redcedar, could be regenerated without taking extraordinary precautions for survival.

A sizable portion of the surveyed area is currently stocked with relatively pure red alder. Most of these areas had been stocked with Douglas-fir prior to early logging. In future entries, these stands could be converted to Douglas-fir. There are portions which undoubtedly had been infected with P. weirii, but because of the rotation of an immune tree species, it should now be safe to grow Douglas-fir on them.

The recommended method for treating mature stands affected by laminated root rot involves two management strategies based on amount of affected area in the unit.

1. In units with at least 25 percent of the area contained in disease centers, the entire block should be treated as a homogenous unit. Following a regeneration-type harvest, nonsusceptible species should be regenerated and managed over the entire block.

2. In units with less than 25 percent of the area in laminated root rot centers, individual diseased areas, including buffers, should be identified and treated. Douglas-fir management should be continued in healthy areas. Infected areas should be delineated on the ground so they may be found following harvest and site preparation. Several approaches can be taken in doing this; fallers may be asked to mark stump tops by making two parallel cuts on trees exhibiting characteristic stain or decay (Plate 5). Another method of marking stumps is to attach metal tags below stump height to symptomatic trees around the periphery of centers. Following site preparation, stumps marked by either systems should be located and a 50-foot buffer added beyond them. The periphery of the treatment area should be clearly marked so that it may be recognized, allowing the manager to regenerate the entire diseased area with species resistant or less susceptible to laminated root rot.

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JAMES S. HADFIELD, Acting Director of Forest Pest Management Date

Plate 1. Laminated decay and pitting, characteristic of laminated root rot, and setal hyphae of *Phellinus weirii*

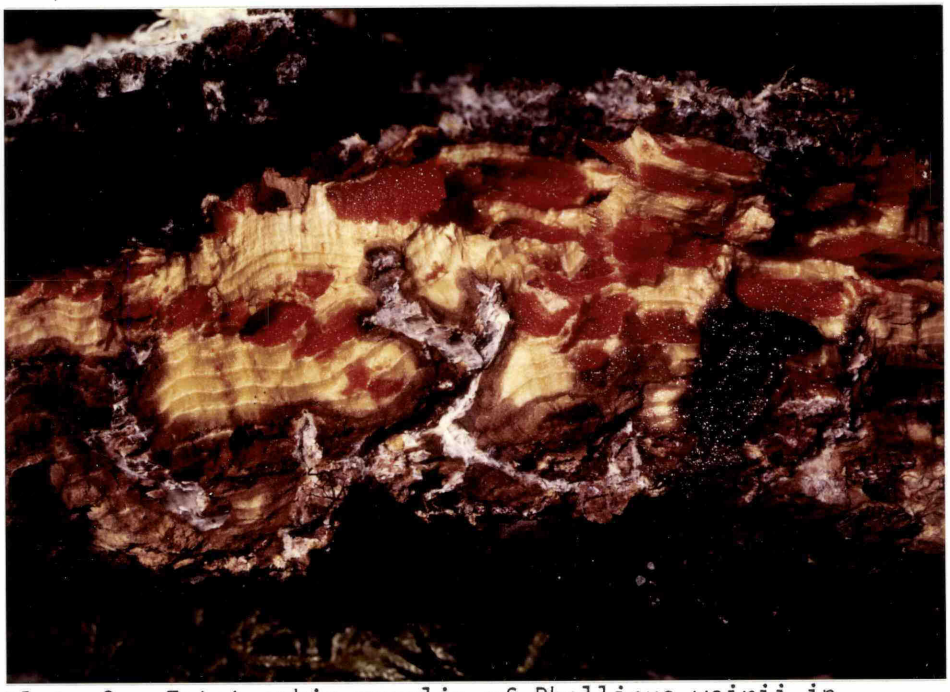

Plate 2. Ectotrophic mycelia of *Phellinus weirii* in bark crevices of mature Douglas-fir

Plate 3. Distinctive fruiting bodies of Phaeolus schweinitzii

Plate 4. Recommended method of marking Phellinus weirii infected stump